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**METHOD OF TEST**  
**MEASURING COATING THICKNESS BY MAGNETIC GAUGE**  
**FIELD TEST PROCEDURES FOR LABORATORY TEST METHOD 803**

**SCOPE**

This test method describes the field test procedure for determining the thickness of a non-magnetic coating on a magnetic substrate by use of a magnetic thickness gate.

**APPARATUS**

1. Inspector gauge with 0 to 635  $\mu\text{m}$  (0 to 25 mil) range or Mikrotest gauge with 0 to 1000  $\mu\text{m}$  (0 to 40 mil) range.
2. Calibration standards consisting of coatings of known thickness bonded to the substrate or plastic shims of known thickness and specimen of uncoated base metal (See section on standards.).

**INSTRUMENT OPERATION**

1. Check the magnet tip to **make** sure it is clean.
2. Place the rubber housing of the magnet on the surface to be measured with the rear contact point of gauge on the same surface or other surface in the same plane. Position the gauge so the magnet is perpendicular to the surface at the contact point (See notes 1 and 2.).
3. Stabilize the gauge in the above position with **your** finger and/or thumb placed on the housing near the magnet (See figure 1.). Hold the gauge steady with firm but gentle downward pressure while operating (See note 3.).
4. **Touch the** magnet to the specimen surface.
5. **Slowly** rotate the dial clockwise until the magnet breaks contact. Separation can be heard or it can be seen by watching the colored pip at front of the gauge (See note 3.).
6. Obtain the thickness measurement from the dial using the same reading mark **as** used for calibration. **This will be either a stationary mark or a movable compensator.**

**CALIBRATION STANDARDS**

The calibration standard used should be selected after consideration of the following factors:

1. Film Composition. The standard film composition should be about the same as the coating being tested, i.e., zinc films for galvanizing and paint films for painting. Plastic shims should

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only be used for curved surfaces coated with a paint-type material (not galvanizing).

2. Film Thickness. The standard film thickness should be as close as possible to thickness being measured. The approximate recommended thicknesses are:

<u>Range of Sample Thickness in <math>\mu\text{m}</math></u>	<u>Range of Sample Thickness in mils</u>	<u>Approximate Standard Thickness in <math>\mu\text{m}</math></u>	<u>Approximate Standard Thickness in mils</u>
7.5 - 40	0.3 - 1.5	25	1
40 - 90	1.5 - 3.5	50	2
60 - 140	2.5 - 5.5	100	4
100 - 200	4 - 8	150	6
200 - 300	8 - 12	250	10

3. Substrate. The **substrate** of the standards should have the same magnetic properties, surface texture (sandblasted, smooth, etc.), curvature, and effective thickness as material being tested (See notes 4 and 5.).

### **INSTRUMENT CALIBRATION**

1. Select a standard film of proper composition, thickness, and substrate.
2. Determine the average of five readings taken at different **points** on the standard film, using the stationary reading mark on the gauge.
3. On gauges with a compensator, rotate the dial so the stationary mark indicates measured thickness found in Step 2. Without moving the dial, set the compensator to indicate actual film thickness of the standard. Subsequent test measurements are read using the compensating mark (See note 6.).
4. If the gauge does not have a compensating mark, determine the difference between the actual standard film thickness and the average measured film thickness found in Step 2. Use this difference to correct subsequent test results (See note 6.).

### **TEST PROCEDURE**

1. Calibrate the gauge as outlined above (See note 7.).
  2. Select a small area [about 100 mm (4 in.) diameter or less] on a smooth portion of test surface. Remove all foreign material. Avoid areas difficult to clean.
  3. Make at least five individual thickness measurements within the small area. These readings should be taken at different **points within the 100 mm (4 in.) spot.** (See note 8.).
  4. Average all individual readings obtained within the small area and apply any calibration
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correction. This average is the test result for that spot on the surface and is called a spot reading (See note 9.).

5. To obtain the overall coating thickness for a large area, average several spot readings representative of the test area (See note 10.).

## **REPORTING RESULTS**

Report test results to the nearest 2  $\mu\text{m}$  (0.1 mil). Use the following conversion factor to convert from mils to  $\mu\text{m}$ :

$$1.0 \text{ mil} = 25.4 \mu\text{m}$$

A zinc coating thickness may be converted to weight per area using the following conversion factors:

$$\begin{aligned} 1.0 \text{ mil} &= 0.59 \text{ ounces per square foot} \\ 1.0 \text{ mil} &= 179.5 \text{ grams per square meter} \\ 1.0 \mu\text{m} &= 7.1 \text{ grams per square meter} \end{aligned}$$

The zinc coating mass for corrugated steel sheet for use in pipe or pipe arches is calculated by adding the mass of the two sides together. For example, if one side of the sheet has an average mass of  $488 \text{ g/m}^2$  (1.6 oz./ft.<sup>2</sup>) and the other side has an average mass of  $427 \text{ g/m}^2$  (1.4 oz./ft.<sup>2</sup>), the mass of the zinc for the entire sheet is reported as  $915 \text{ g/m}^2$  (3.0 oz./ft.<sup>2</sup>).

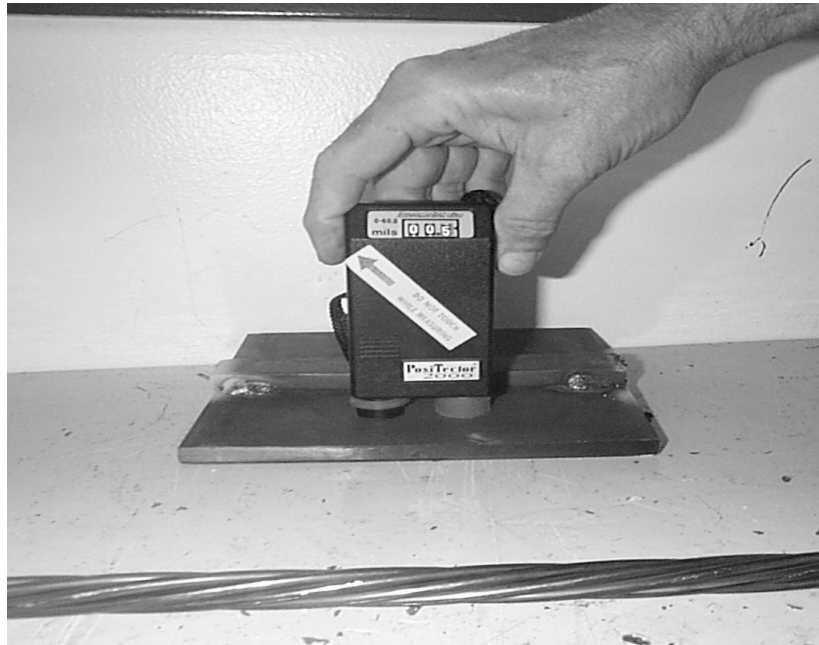
## **NOTES AND PRECAUTIONS**

1. Instrument Position. The gauge position during measurements, i.e., upright, horizontal, or upside down, may affect results. Calibration for different positions should be verified. The gauge should be positioned parallel to the longitudinal axis of cylindrical specimens.
2. Edge Effect. Measurements should not be taken closer than 6 mm (¼ in.) from edges or inside corners.
3. Instrument Operation. Different finger pressures applied to hold the gauge and different rates of rotating the gauge dial may affect results. The magnet should separate from the surface only while the dial is moving slowly and smoothly. Operation technique and measurement consistency can be checked by taking repeated readings on the same point without changing gauge position. Calibration by same the operator who makes the test measurements will reduce or eliminate these variations.
4. Effective Substrate Thickness. Substrate thickness of 0.76 mm or 760  $\mu\text{m}$  (0.030 in.) or more are equivalent. This effective thickness for flat specimens may be increased by placing the specimen on a flat layer of material with similar magnetic properties.

The gauge must be calibrated on a substrate of same thickness if sample measurements are taken on specimens less than 0.76 mm or 760  $\mu\text{m}$  (0.030 in.) thick.

5. Curvature Effect. For measurements on curved surfaces, the gauge should be calibrated on

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- a standard with similar curvature or with a shim placed on similarly curved base metal. Measurements made on cylindrical specimens of 25 mm (1 in.) diameter or more, may be done by calibrating the gauge with a standard and subtracting 7.6  $\mu\text{m}$  (0.3 mil) from result.
6. Measurement Corrections. Best results are obtained when compensation or applied corrections are small.
  7. Calibration Frequency. To assure proper performance, calibrate the gauge before each use and at frequent intervals during use.
  8. Number of Measurements. The number of individual readings that should be taken in a particular spot depends on the uniformity of the coating thickness. For example, ten readings are recommended for galvanizing on culvert metal and five readings are taken on paint over a sandblasted surface.
  9. Valid Measurements. Only averages of several individual measurements taken in the spot area are valid results. Individual measurements that are obviously too high may result from gauge vibration and should be discarded.
  10. Test Areas. A test area on which an overall average coating thickness is determined may be of any designated size of continuous flat surface or curved surface of the same radius. To avoid unnecessary coating repairs it may be desirable to divide a large test area into smaller inspection units.
  11. Instrument Care. Magnetic gauges are delicate instruments and should be handled as such. Store in the case provided when not in use.
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**Figure 1.** Operation of Film Thickness Gauge



**Figure 2.** Calibration Standards

## Steel Structures Painting Council

# SURFACE PREPARATION SPECIFICATION NO. 1

### Solvent Cleaning

#### 1. Scope

1.1 This specification covers the requirements for the solvent cleaning of steel surfaces.

#### 2. Definition

2.1 Solvent cleaning is a method for removing all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces.

2.2 It is intended that solvent cleaning be used prior to the application of paint and in conjunction with surface preparation methods specified for the removal of rust, mill scale, or paint.

#### 3. Surface Preparation Before and After Solvent Cleaning

3.1 Prior to solvent cleaning, remove foreign matter (other than grease and oil) by one or a combination of the following: brush with stiff fiber or wire brushes, abrade, scrape, or clean with solutions of appropriate cleaners, provided such cleaners are followed by a fresh water rinse.

3.2 After solvent cleaning, remove dirt, dust, and other contaminants from the surface prior to paint application. Acceptable methods include brushing, blow off with clean, dry air, or vacuum cleaning.

#### 4. Methods of Solvent Cleaning

4.1 Remove heavy oil or grease first by scraper. Then remove the remaining oil or grease by any of the following methods:

4.1.1 Wipe or scrub the surface with rags or brushes wetted with solvent. Use clean solvent and clean rags or brushes for the final wiping.

4.1.2 Spray the surface with solvent. Use clean solvent for the final spraying.

4.1.3 Vapor degrease using stabilized chlorinated hydrocarbon solvents.

4.1.4 Immerse completely in a tank or tanks of solvent. For the last immersion, use solvent which does not contain detrimental amounts of contaminant.

4.1.5 Emulsion or alkaline cleaners may be used in place of the methods described. After treatment, wash the surface with fresh water or steam to remove detrimental residues.

4.1.6 Steam clean, using detergents or cleaners and follow by steam or fresh water wash to remove detrimental residues.

#### 5. Inspection

5.1 All work and materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work or replace such material as is found defective under this specification. In case of dispute the arbitration or settlement procedure established in the procurement documents, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure specified by the American Arbitration Association shall be used.

5.2 The procurement documents covering work or purchase should establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

#### 6. Safety

6.1 All safety requirements stated in this specification and its component parts apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions and requirements of insurance underwriters.

#### 7. Notes\*

7.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, the SSPC cannot assume responsibility or incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

7.2 A Commentary Section is available (Chapter 2 of Volume 2 of the Steel Structures Painting Manual) and contains additional information and data relative to this specification. The Surface Preparation Commentary, SSPC-SP COM, is not part of this specification. The table below lists the subjects discussed relevant to solvent cleaning and appropriate Commentary Section.

Subject	SSPC-SP COM Section
Solvents and Cleaners . . . . .	11.1 through 11.1.3
Steam Cleaning . . . . .	11.1.4
Threshold Limit Values . . . . .	11.1.5
Film Thickness . . . . .	10

\*Notes are not requirements of this specification.

## Steel Structures Painting Council

# SURFACE PREPARATION SPECIFICATION NO. 2

### Hand Tool Cleaning

#### 1. Scope

1.1 This specification covers the requirements for the hand tool cleaning of steel surfaces.

#### 2. Definitions

2.1 Hand tool cleaning is a method of preparing steel surfaces by the use of non-power hand tools.

2.2 Hand tool cleaning removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.

2.3 ISO 8501-1:1988 or other visual standards of surface preparation agreed upon by the contracting parties may be used to further define the surface.

#### 3. Reference Standards

3.1 The standards referenced in this specification are listed in Section 3.4 and form a part of the specification.

3.2 The latest issue, revision, or amendment of the reference standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and the specification, the requirements of the specification shall prevail.

3.4 **STEEL STRUCTURES PAINTING COUNCIL (SSPC) SPECIFICATIONS:**

SSPC-SP 1 Solvent Cleaning

3.5 **International Organization for Standardization (ISO):**

8501-1:1988 Preparation of steel substrates before application of paints and related products: visual assessment of surface cleanliness, Part I

#### 4. Surface Preparation Before and After Hand Tool Cleaning

4.1 Before hand tool cleaning, remove visible oil, grease, soluble welding residues, and salts by the methods outlined in SSPC-SP 1.

4.2 After hand tool cleaning and prior to painting, reclean the surface if it does not conform to this specification.

4.3 After hand tool cleaning and prior to painting, remove dirt, dust, or similar contaminants from the surface. Acceptable methods include brushing, blow off with clean, dry air, or vacuum cleaning.

#### 5. Methods of Hand Tool Cleaning

5.1 Use impact hand tools to remove stratified rust (rust scale).

5.2 Use impact hand tools to remove all weld slag.

5.3 Use hand wire brushing, hand abrading, hand scraping, or other similar non-impact methods to remove all loose mill scale, all loose or non-adherent rust, and all loose paint.

5.4 Regardless of the method used for cleaning, if specified in the procurement documents, feather edges of remaining old paint so that the repainted surface can have a reasonably smooth appearance.

5.5 If approved by the owner, use power tools or blast cleaning as a substitute cleaning method for this specification.

#### 6. Inspection

6.1 All work and materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work or replace such material as is found defective under this specification. In case of dispute the arbitration or settlement procedure established in the procurement documents, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure specified by the American Arbitration Association shall be used.

6.2 The procurement documents covering work or purchase should establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

#### 7. Safety

7.1 All safety requirements stated in this specification and its component parts apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions and requirements of insurance underwriters.

#### 8. Notes\*

8.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, the SSPC cannot assume responsibility or incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

## Steel Structures Painting Council

# SURFACE PREPARATION SPECIFICATION NO. 3

### Power Tool Cleaning

#### 1. Scope

1.1 This specification covers the requirements for the power tool cleaning of steel surfaces.

#### 2. Definition

2.1 Power tool cleaning is a method of preparing steel surfaces by the use of power assisted hand tools.

2.2 Power tool cleaning removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter. It is not intended that adherent mill scale, rust, and paint be removed by this process. Mill scale, rust, and paint are considered adherent if they cannot be removed by lifting with a dull putty knife.

2.3 ISO 8501-1:1988 or other visual standards of surface preparation agreed upon by the contracting parties may be used to further define the surface.

#### 3. Reference Standards

3.1 The standards referenced in this specification are listed in Section 3.4 and form a part of the specification.

3.2 The latest issue, revision or amendment of the reference standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and the specification, the requirements of the specification shall prevail.

3.4 **STEEL STRUCTURES PAINTING COUNCIL (SSPC) SPECIFICATIONS:**

SSPC-SP 1 Solvent Cleaning

3.5 **International Organization for Standardization (ISO):**

8501-1:1988 Preparation of Steel Substrates Before Application of Paints and Related Products: Visual Assessment of Surface Cleanliness, Part I

#### 4. Surface Preparation Before and After Power Tool Cleaning

4.1 Before power tool cleaning, remove visible oil, grease, soluble welding residue, and salts by the methods outlined in SSPC-SP 1.

4.2 After power tool cleaning and prior to painting, reclean the surface if it does not conform to this specification.

4.3 After power tool cleaning and prior to painting, remove dirt, dust, or similar contaminants from the surface. Acceptable methods include brushing, blow off with clean, dry air, or vacuum cleaning.

#### 5. Methods of Power Tool Cleaning

5.1 Use rotary or impact power tools to remove stratified rust (rust scale).

5.2 Use rotary or impact power tools to remove all weld slag.

5.3 Use power wire brushing, power abrading, power impact or other power rotary tools to remove all loose mill scale, all loose or non-adherent rust, and all loose paint. Do not burnish the surface.

5.4 Operate power tools in a manner that prevents the formation of burrs, sharp ridges, and sharp cuts.

5.5 Regardless of the method used for cleaning, if specified in the procurement documents, feather edges of remaining old paint so that the repainted surface can have a reasonably smooth appearance.

5.6 If approved by the owner, use blast cleaning as a substitute cleaning method for this specification.

#### 6. Inspection

6.1 All work and materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work or replace such material as is found defective under this specification. In case of dispute the arbitration or settlement procedure established in the procurement documents, if any, shall be followed. If no arbitration or settlement procedure is established, the procedure specified by the American Arbitration Association shall be used.

6.2 The procurement documents covering work or purchase should establish the responsibility for testing and for any required affidavit certifying full compliance with the specification.

#### 7. Safety

7.1 All safety requirements stated in this specification and its component parts apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions and requirements of insurance underwriters.

#### 8. Notes\*

8.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, the SSPC cannot assume responsibility or incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.



## Steel Structures Painting Council

# SURFACE PREPARATION SPECIFICATION NO. 6

## Commercial Blast Cleaning

### 1. Scope

1.1 This specification covers the requirements for Commercial Blast Cleaning of steel surfaces by the use of abrasives.

### 2. Definition

2.1 A Commercial Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining, as noted in Section 2.2.

2.2 Staining shall be limited to no more than 33 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied paint. Slight residues of rust and paint may also be left in the bottoms of pits if the original surface is pitted.

2.3 **ACCEPTABLE VARIATIONS IN APPEARANCE THAT DO NOT AFFECT SURFACE CLEANLINESS** as defined in Sections 2.1 and 2.2 include variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat affected zones, blasting abrasive, and differences in the blast pattern.

2.4 When painting is specified, the surface shall be roughened to a degree suitable for the specified paint system.

2.5 Immediately prior to paint application, the surface shall comply with the degree of cleaning as specified herein.

2.6 SSPC-Vis 1-89 or other visual standards of surface preparation may be specified to supplement the written definition.

\*NOTE: Additional information on visual standards is available in Section A.4 of the Appendix.

### 3. Blast Cleaning Abrasives

3.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

\*Notes are not requirements of this specification.

3.2 The cleanliness and size of recycled abrasives shall be maintained to insure compliance with this specification.

3.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other harmful materials at the time of use.

3.4 Any limitations or restrictions on the use of specific abrasives, quantity of contaminants, or degree of embedment shall be included in the procurement documents (project specification) covering the work, since abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements.

\*NOTE: Additional information on abrasive selection is available in Section A.2 of the Appendix.

### 4. Reference Standards

4.1 If there is a conflict between the cited reference standards and this specification, this specification shall prevail unless otherwise indicated in the procurement documents (project specification).

4.2 The standards referenced in this specification are:

SSPC-SP 1 Solvent Cleaning  
SSPC-Vis 1-89 Visual Standard for Abrasive Blast Cleaned Steel

### 5. Procedure Before Blast Cleaning

5.1 Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.

5.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification).

\*NOTE: Additional information on surface imperfections is available in Section A.5 of the Appendix.

### 6. Blast Cleaning Methods and Operation

6.1 Clean, dry, compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps or other equipment may be necessary to achieve this requirement.

# Steel Structures Painting Council

## SURFACE PREPARATION SPECIFICATION NO. 7

### Brush-Off Blast Cleaning

#### 1. Scope

1.1 This specification covers the requirements for Brush-Off Blast Cleaning of steel surfaces by the use of abrasives.

#### 2. Definition

2.1 A Brush-Off Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose paint. Tightly adherent mill scale, rust, and paint may remain on the surface. Mill scale, rust, and paint are considered tightly adherent if they cannot be removed by lifting with a dull putty knife.

2.2 The entire surface shall be subjected to the abrasive blast. The remaining mill scale, rust, or paint shall be tight.

2.3 When painting is specified, the surface shall be roughened to a degree suitable for the specified paint system.

2.4 Immediately prior to paint application, the surface shall comply with the degree of cleaning as specified herein.

2.5 SSPC-Vis 1-89 or other visual standards of surface preparation may be specified to supplement the written definition.

\*NOTE: Additional information on visual standards is available in Section A.4 of the Appendix.

#### 3. Blast Cleaning Abrasives

3.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

3.2 The cleanliness and size of recycled abrasives shall be maintained to insure compliance with this specification.

3.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other harmful materials at the time of use.

3.4 Any limitations or restrictions on the use of specific abrasives, quantity of contaminants, or degree of

embedment shall be included in the procurement documents (project specification) covering the work, since abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements.

\*NOTE: Additional information on abrasive selection is available in Section A.2 of the Appendix.

#### 4. Reference Standards

4.1 If there is a conflict between the cited reference standards and this specification, this specification shall prevail unless otherwise indicated in the procurement documents (project specification).

4.2 The standards referenced in this specification are:

SSPC-SP 1 Solvent Cleaning

SSPC-Vis 1-89 Visual Standard for Abrasive Blast Cleaned Steel

#### 5. Procedure Before Blast Cleaning

5.1 Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.

#### 6. Blast Cleaning Methods and Operation

6.1 Clean, dry, compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps or other equipment may be necessary to achieve this requirement.

6.2 Any of the following methods of surface preparation may be used to achieve a Brush-Off Blast Cleaned surface:

6.2.1 Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

6.2.2 Dry abrasive blasting using a closed cycle, recirculating abrasive system with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.

6.2.3 Dry abrasive blasting, using a closed cycle, recirculating abrasive system with centrifugal wheels and abrasive.

6.3 Other methods of surface preparation (such as wet abrasive blasting) may be used to achieve a Brush-Off Blast Cleaned surface by mutual agreement between the

\*Notes are not requirements of this specification.

party responsible for performing the work and the party responsible for establishing the requirements or his representative.

\*NOTE: If wet abrasive blasting is used, information on the use of inhibitors to prevent the formation of rust immediately after wet blast cleaning is contained in Section A.8 of the Appendix

## 7. Procedures Following Blast Cleaning and Immediately Prior to Painting

7.1 Visible deposits of oil, grease, or other contaminants shall be removed by any of the methods specified in SSPC-SP 1 or other methods agreed upon by the party responsible for establishing the requirements and the party responsible for performing the work.

7.2 Dust and loose residues shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning or other methods agreed upon by the party responsible for establishing the requirements and the party responsible for performing the work. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

## 8. Inspection

8.1 Work and materials supplied under this specification are subject to inspection by the party responsible for establishing the requirements or his representative. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by the party responsible for establishing the requirements and the party responsible for performing the work.

8.2 Conditions not complying with this specification shall be corrected. In case of dispute the arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, then the procedure established by the American Arbitration Association shall be used.

8.3 The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

## 9. Safety and Environmental Requirements

9.1 Blast cleaning is a hazardous operation. Therefore, all work shall be conducted in such a manner to comply with all applicable insurance underwriter, local, state, and federal safety and environmental rules and requirements.

\*NOTE: SSPC-PA Guide 3, "A Guide to Safety in Paint Application," addresses safety concerns for coating work.

## 10. Comments

10.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as ac-

curate, complete, and useful as possible, the Steel Structures Painting Council cannot assume responsibility nor incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

10.2 Additional information and data relative to this specification are contained in the following brief Appendix. More detailed information and data are presented in a separate document, SSPC-SP COM, "Surface Preparation Commentary." The recommendations contained in the Notes, Appendix, and SSPC-SP COM are believed to represent good practice, but are not to be considered as requirements of the specification. The table below lists the subjects discussed relevant to Brush-Off Blast Cleaning and appropriate section of SSPC-SP COM.

Subject	Commentary Section
Abrasive Selection . . . . .	5
Degree of Cleaning . . . . .	11.7
Film Thickness . . . . .	10
Wet Abrasive Blast Cleaning . . . . .	9
Maintenance Painting . . . . .	3.2
Rust Back (Rerusting) . . . . .	8
Surface Profile . . . . .	6
Visual Standards . . . . .	7
Weld Spatter . . . . .	4.1

## A. Appendix

**A.1 FUNCTION**—Brush-Off Blast Cleaning (SSPC-SP 7) provides a lesser degree of cleaning than Commercial Blast Cleaning (SSPC-SP 6). It should be used where the service environment is mild enough to permit tight mill scale, paint, rust, and other foreign matter to remain on the surface. The primary functions of blast cleaning before painting are: (a) to remove material from the surface that can cause early failure of the coating system, and (b) to obtain a suitable surface roughness.

**A.2 ABRASIVE SELECTION**—Types of metallic and non-metallic abrasives are discussed in the Surface Preparation Commentary (SSPC-SP COM). Requirements for selecting and evaluating mineral and slag abrasives are given in SSPC-AB 1, "Mineral and Slag Abrasives."

**A.3 SURFACE PROFILE**—Surface profile is the roughness of the surface which results from abrasive blast cleaning. The profile depth (or height) is dependent upon the size, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of recycling, and the proper maintenance of working mixtures of grit and/or shot.

**A.4 VISUAL STANDARDS**—Note that the use of visual standards in conjunction with this specification is required only when they are specified in the procurement documents (project specification) covering the work. It is recommended, however, that the use of visual standards be made mandatory in the procurement documents (project specification).

SSPC-Vis 1-89 "Visual Standard for Abrasive Blast

dition of the steel. The following table lists the photographs for this specification that are applicable to the rust grades listed below.

Rust Grade	Mill Scale and Rust	100% Rust	100% Rust with Pits
Pictorial Standards	B SP 7	C SP 7	D SP 7

Many other visual standards are available and are described in Section 7 of the Commentary (SSPC-SP COM).

**A.5 DEW POINT**—Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is, therefore, recommended that the temperature of steel surface be at least 5 degrees F (3 degrees C) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations. It is important that the application of paint over a damp surface be avoided.

**A.6 WET ABRASIVE BLAST CLEANING**—Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing (studies have shown that water of at least 15,000 ohm-cm resistivity is preferred). It may be necessary that inhibitors be added to the water or applied to the surface immediately after blast cleaning to temporarily prevent rust formation. The coating should then be

applied before any rusting is visible. One inhibitive treatment for blast cleaned surfaces is water containing 0.32% sodium nitrite and 1.28% by weight secondary ammonium phosphate (dibasic).

CAUTION: Some inhibitive treatments may interfere with the performance of certain coating systems.

**A.7 FILM THICKNESS**—It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry paint film thickness above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured, refer to SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Gages."

**A.8 MAINTENANCE AND REPAIR PAINTING**—When this specification is used in maintenance painting, specific instructions should be given on the extent of surface to be blast cleaned or spot blast cleaned to this degree of cleanliness. SSPC-PA Guide 4, "Guide to Maintenance Repainting with Oil Base or Alkyd Painting Systems," provides a description of accepted practices for retaining old sound paint, removing unsound paint, feathering, and spot cleaning.

# Steel Structures Painting Council

## SURFACE PREPARATION SPECIFICATION NO. 10

### Near-White Blast Cleaning

#### 1. Scope

1.1 This specification covers the requirements for Near-White Blast Cleaning of steel surfaces by the use of abrasives.

#### 2. Definition

2.1 A Near-White Blast Cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter, except for staining as noted in Section 2.2.

2.2 Staining shall be limited to no more than 5 percent of each square inch of surface area and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied paint.

2.3 **ACCEPTABLE VARIATIONS IN APPEARANCE THAT DO NOT AFFECT SURFACE CLEANLINESS** as defined in Sections 2.1 and 2.2 include variations caused by type of steel, original surface condition, thickness of the steel, weld metal, mill or fabrication marks, heat treating, heat affected zones, blasting abrasives, and differences in the blast pattern.

2.4 When painting is specified, the surface shall be roughened to a degree suitable for the specified paint system.

2.5 Immediately prior to paint application, the surface shall comply with the degree of cleaning as specified herein.

2.6 SSPC-Vis 1-89 or other visual standards of surface preparation may be specified to supplement the written definition.

\*NOTE: Additional information on visual standards is available in Section A.4 of the Appendix.

#### 3. Blast Cleaning Abrasives

3.1 The selection of abrasive size and type shall be based on the type, grade, and surface condition of the steel to be cleaned, type of blast cleaning system employed, the finished surface to be produced (cleanliness and roughness), and whether the abrasive will be recycled.

3.2 The cleanliness and size of recycled abrasives shall be maintained to insure compliance with this specification.

3.3 The blast cleaning abrasive shall be dry and free of oil, grease, and other harmful materials at the time of use.

3.4 Any limitations or restrictions on the use of specific abrasives, quantity of contaminants, or degree of embedment shall be included in the procurement documents (project specification) covering the work, since abrasive embedment and abrasives containing contaminants may not be acceptable for some service requirements.

\*NOTE: Additional information on abrasive selection is available in Section A.2 of the Appendix.

#### 4. Reference Standards

4.1 If there is a conflict between the cited reference standards and this specification, this specification shall prevail unless otherwise indicated in the procurement documents (project specification).

4.2 The standards referenced in this specification are:

SSPC-SP 1 Solvent Cleaning  
SSPC-Vis 1-89 Visual Standard for Abrasive Blast Cleaned Steel

#### 5. Procedure Before Blast Cleaning

5.1 Before blast cleaning, visible deposits of oil or grease shall be removed by any of the methods specified in SSPC-SP 1 or other agreed upon methods.

5.2 Before blast cleaning, surface imperfections such as sharp fins, sharp edges, weld spatter, or burning slag should be removed from the surface to the extent required by the procurement documents (project specification).

\*NOTE: Additional information on surface imperfections is available in Section A.5 of the Appendix.

#### 6. Blast Cleaning Methods and Operation

6.1 Clean, dry, compressed air shall be used for nozzle blasting. Moisture separators, oil separators, traps

\*Notes are not requirements of this specification.

or other equipment may be necessary to achieve this requirement.

**6.2** Any of the following methods of surface preparation may be used to achieve a Near-White Blast Cleaned surface:

**6.2.1** Dry abrasive blasting using compressed air, blast nozzles, and abrasive.

**6.2.2** Dry abrasive blasting using a closed cycle, recirculating abrasive system with compressed air, blast nozzle, and abrasive, with or without vacuum for dust and abrasive recovery.

**6.2.3** Dry abrasive blasting, using a closed cycle, recirculating abrasive system with centrifugal wheels and abrasive.

**6.3** Other methods of surface preparation (such as wet abrasive blasting) may be used to achieve a Near-White Blast Cleaned surface by mutual agreement between the party responsible for performing the work and the party responsible for establishing the requirements or his representative.

\*NOTE: If wet abrasive blasting is used, information on the use of inhibitors to prevent the formation of rust immediately after wet blast cleaning is contained in Section A.9 of the Appendix

## **7. Procedures Following Blast Cleaning and Immediately Prior to Painting**

**7.1** Visible deposits of oil, grease, or other contaminants shall be removed by any of the methods specified in SSPC-SP 1 or other methods agreed upon by the party responsible for establishing the requirements and the party responsible for performing the work.

**7.2** Dust and loose residues shall be removed from prepared surfaces by brushing, blowing off with clean, dry air, vacuum cleaning or other methods agreed upon by the party responsible for establishing the requirements and the party responsible for performing the work. Moisture separators, oil separators, traps, or other equipment may be necessary to achieve clean, dry air.

**7.3** After blast cleaning, surface imperfections which remain (i.e., sharp fins, sharp edges, weld spatter, burning slag, scabs, slivers, etc.) shall be removed to the extent required in the procurement documents (project specification). Any damage to the surface profile resulting from the removal of surface imperfections shall be corrected to meet the requirements of Section 2.4.

\*NOTE: Additional information on surface imperfections is contained in Section A.5 of the Appendix.

**7.4** Any visible rust that forms on the surface of the steel after blast cleaning shall be removed by reblasting the rusted areas to meet the requirements of this

specification before painting.

\*NOTE: Information on rust-back (rerusting) and surface condensation is contained in Sections A.7 and A.8 of the Appendix.

## **8. Inspection**

**8.1** Work and materials supplied under this specification are subject to inspection by the party responsible for establishing the requirements or his representative. Materials and work areas shall be accessible to the inspector. The procedures and times of inspection shall be as agreed upon by the party responsible for establishing the requirements and the party responsible for performing the work.

**8.2** Conditions not complying with this specification shall be corrected. In case of dispute the arbitration or settlement procedure established in the procurement documents (project specification) shall be followed. If no arbitration or settlement procedure is established, then the procedure established by the American Arbitration Association shall be used.

**8.3** The procurement documents (project specification) should establish the responsibility for inspection and for any required affidavit certifying compliance with the specification.

## **9. Safety and Environmental Requirements**

**9.1** Blast cleaning is a hazardous operation. Therefore, all work shall be conducted in such a manner to comply with all applicable insurance underwriter, local, state, and federal safety and environmental rules and requirements.

\*NOTE: SSPC-PA Guide 3, "A Guide to Safety in Paint Application," addresses safety concerns for coating work.

## **10. Comments**

**10.1** While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, the Steel Structures Painting Council cannot assume responsibility nor incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

**10.2** Additional information and data relative to this specification are contained in the following brief Appendix. More detailed information and data are presented in a separate document, SSPC-SP COM, "Surface Preparation Commentary." The recommendations contained in the Notes, Appendix, and SSPC-SP COM are believed to represent good practice, but are not to be considered as requirements of the specification. The table below lists the subjects discussed relevant to Near-White Blast Cleaning

and appropriate section of SSPC-SP COM.

Subject	Commentary Section
Abrasive Selection .....	5
Degree of Cleaning .....	11.10
Film Thickness .....	10
Wet Abrasive Blast Cleaning .....	9
Maintenance Painting .....	3.2
Rust Back (Rerusting) .....	8
Surface Profile .....	6
Visual Standards .....	7
Weld Spatter .....	4.1

## A. Appendix

**A.1 FUNCTION**—Near-White Blast Cleaning (SSPC-SP 10) provides a greater degree of cleaning than Commercial Blast Cleaning (SSPC-SP 6) but less than White Metal Blast Cleaning (SSPC-SP 5). It should be used where a high degree of blast cleaning is required. The primary functions of blast cleaning before painting are: (a) to remove material from the surface that can cause early failure of the coating system, and (b) to obtain a suitable surface roughness.

**A.2 ABRASIVE SELECTION**—Types of metallic and non-metallic abrasives are discussed in the Surface Preparation Commentary (SSPC-SP COM). It is important to recognize that blasting abrasives may become embedded in or leave residues on the surface of the steel during preparation. While normally such embedment or residues are not detrimental, care should be taken (particularly if the prepared steel is to be used in an immersion environment) to assure that the abrasive is free from detrimental amounts of water soluble, solvent soluble, acid soluble, or other such soluble materials. Requirements for selecting and evaluating mineral and slag abrasives are given in SSPC-AB 1, "Mineral and Slag Abrasives."

**A.3 SURFACE PROFILE**—Surface profile is the roughness of the surface which results from abrasive blast cleaning. The profile depth (or height) is dependent upon the size, type, and hardness of the abrasive, particle velocity and angle of impact, hardness of the surface, amount of recycling, and the proper maintenance of working mixtures of grit and/or shot.

The allowable minimum/maximum height of profile is usually dependent upon the thickness of the paint to be applied. Large particle sized abrasives (particularly metallic) can produce a profile which may be too deep to be adequately covered by a single thin film coat. Accordingly, it is recommended that the use of larger abrasives be avoided in these cases. However, larger abrasives may be needed for thick film coatings or to facilitate removal of heavy mill scale or rust. If control of profile (minimum/maximum) is deemed to be significant to coatings performance, it should be addressed in the procurement documents (project specification).

Typical maximum profile heights achieved with com-

mercial abrasive media are shown in Table 8 of the Surface Preparation Commentary (SSPC-SP COM). Methods (i.e., comparators, replica tape, depth micrometers) are available to aid in estimating the profile of surfaces blast cleaned with sand, steel grit, and steel shot.

**A.4 VISUAL STANDARDS**—Note that the use of visual standards in conjunction with this specification is required only when they are specified in the procurement documents (project specification) covering the work. It is recommended, however, that the use of visual standards be made mandatory in the procurement documents (project specification).

SSPC-Vis 1-89, "Visual Standard for Abrasive Blast Cleaned Steel," provides color photographs for the various grades of surface preparation as a function of the initial condition of the steel. The following table lists the photographs for this specification that are applicable to the rust grades listed below.

	100% Adherent Mill Scale	100% Mill Scale and Rust	100% Rust	100% Rust With Pits
Rust Grade				
Pictorial				
Standards	A SP 10	B SP 10	C SP 10	D SP 10

Many other visual standards are available and are described in Section 7 of the Commentary (SSPC-SP COM).

**A.5 SURFACE IMPERFECTIONS**—Surface imperfections can cause premature failure when the service is severe. Coatings tend to pull away from sharp edges and projections, leaving little or no coating to protect the underlying steel. Other features which are difficult to properly cover and protect include crevices, weld porosity, laminations, etc. The high cost of the methods to remedy the surface imperfections requires weighing the benefits of edge rounding, weld spatter removal, etc., versus a potential coating failure.

Poorly adhering contaminants, such as weld slag residues, loose weld spatter, and some minor surface laminations, may be removed during the blast cleaning operation. Other surface defects (steel laminations, weld porosities, or deep corrosion pits) may not be evident until the surface preparation has been completed. Therefore, proper planning for such surface repair work is essential since the timing of the repairs may occur before, during, or after the blast cleaning operation. Section 4 of the Commentary (SSPC-SP COM) contains additional information on surface imperfections.

**A.6 CHEMICAL CONTAMINATION**—Steel contaminated with soluble salts (i.e., chlorides and sulfates) develops rust-back rapidly at intermediate and high humidities. These soluble salts can be present on the steel surface prior to blast cleaning as a result of atmospheric contamination. In addition, contaminants can be de-

posited on the steel surface during blast cleaning whenever the abrasive is contaminated. Therefore, rust-back can be minimized by removing these salts from the steel surface, preferably before blast cleaning and eliminating sources of recontamination during and after blast cleaning. Identification of the contaminants along with their concentrations may be obtained from laboratory and field tests. A number of tests for soluble salts are now under study by the SSPC, ASTM, Maritime Administration, and ISO.

**A.7 RUST-BACK**—Rust-back (rerusting) occurs when freshly cleaned steel is exposed to conditions of high humidity, moisture, contamination, or a corrosive atmosphere. The time interval between blast cleaning and rust-back will vary greatly from one environment to another. Under mild ambient conditions it is best to blast clean and coat a surface the same day. Severe conditions may require coating more quickly while for exposure under controlled conditions the coating time may be extended. Under no circumstances should the steel be permitted to rust-back before painting regardless of the time elapsed (see Appendix A.6).

**A.8 DEW POINT**—Moisture condenses on any surface that is colder than the dew point of the surrounding air. It is, therefore, recommended that the temperature of steel surface be at least 5 degrees F (3 degrees C) above the dew point during dry blast cleaning operations. It is advisable to visually inspect for moisture and periodically check the surface temperature and dew point during blast cleaning operations. It is important that the application of paint over a damp surface be avoided.

**A.9 WET ABRASIVE BLAST CLEANING**—Steel that is wet abrasive blast cleaned may rust rapidly. Clean water should be used for rinsing (studies have shown that water of at least 15,000 ohm-cm resistivity is preferred). It may be necessary that inhibitors be added to the water or applied to the surface immediately after blast cleaning to temporarily prevent rust formation. The coating should then be applied before any rusting is visible. One inhibitive treatment for blast cleaned surfaces is water containing 0.32% sodium nitrite and 1.28% by weight secondary ammonium phosphate (dibasic).

CAUTION: Some inhibitive treatments may interfere with the performance of certain coating systems.

**A.10 FILM THICKNESS**—It is essential that ample coating be applied after blast cleaning to adequately cover the peaks of the surface profile. The dry paint film thickness above the peaks of the profile should equal the thickness known to be needed for the desired protection. If the dry film thickness over the peaks is inadequate, premature rust-through or failure will occur. To assure that coating thicknesses are properly measured, refer to SSPC-PA 2, "Measurement of Dry Paint Thickness with Magnetic Gages."

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